



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/072,798	02/07/2002	Ming-Huan Tsai	67,200-556	1880

7590 12/08/2003

TUNG & ASSOCIATES
Suite 120
838 W. Long Lake Road
Bloomfield Hills, MI 48302

EXAMINER

DEO, DUY VU NGUYEN

ART UNIT

PAPER NUMBER

1765

DATE MAILED: 12/08/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/072,798

Applicant(s)

TSAI ET AL.

Examiner

DuyVu n Deo

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 February 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 07 February 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

2. Claims 1, 2, 4-6, 15, are rejected under 35 U.S.C. 102(e) as being anticipated by Pike et al. (US 6,420,097).

Pike describes a hardmask trim process comprising: providing a wafer including multiple layers comprising at least silicon nitride or titanium nitride (claimed metal nitride layer) overlying a polysilicon layer (col. 3, line 60-col. 4, line 7); anisotropically etching through the metal nitride layer using a pattern photoresist mask to reveal a first exposed portion of the polysilicon layer (claimed photolithographically patterning the metal nitride layer to form a patterned etching surface and anisotropically etching through the patterned etching surface to reveal a first exposed portion of the polysilicon layer) (col. 4, line 14-18; col. 15, line 1-3); isotropically etching the metal nitride to reduce the metal nitride's width to reveal a second portion of the polysilicon layer (claimed isotropically wet etching the metal nitride to reduce a dimension of the hardmask; please also see cited art below for anisotropically and isotropically etching) (col. 4, line 20-29; col. 5, line 3-5); anisotropically etching the polysilicon to form a gate structure (claimed anisotropically plasma etching the second exposed portion of the polysilicon layer to form a feature) (col. 4, line 34-42).

3. Claims 1, 2, 4-6, and 15 are rejected under 35 U.S.C. 102(b) as being McKee by (5,804,088).

McKee describes a hardmask trim process comprising: providing a wafer including multiple layers comprising at least titanium nitride (claimed metal nitride layer) overlying a polysilicon layer (col. 5, line 22-31); anisotropically plasma etching through the metal nitride layer using a pattern photoresist mask to reveal a first exposed portion of the polysilicon layer (claimed photolithographically patterning the metal nitride layer to form a patterned etching surface and anisotropically etching through the patterned etching surface to reveal a first exposed

portion of the polysilicon layer) (col. 5, line 42-50); isotropically wet etching the metal nitride to reduce the metal nitride's width to reveal a second portion of the polysilicon layer (claimed isotropically wet etching the metal nitride to reduce a dimension of the hardmask; please also see cited art below for anisotropically and isotropically etching) (col. 5, line 59-65); anisotropically etching the polysilicon to form a gate structure (claimed anisotropically plasma etching the second exposed portion of the polysilicon layer to form a feature) (col. 6, line 7-12).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 3, 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pike as applied to claims 2 and 15 above.

Referring to claims 3 and 20, Pike describes that the initial linewidth is controllably etched until the desired gate linewidth is achieved. The desired linewidth is less than 0.25 um (col. 3, line 14-16). It would have been obvious for one skill in the art to determine the desired linewidth through routine experimentation in order to provide optimum linewidth for the gate with a reasonable expectation of success.

6. Claims 3 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over McKee as applied to claims 2 and 15 above, and further in view of Pike.

Referring to claims 3 and 20, McKee doesn't describes that width is reduced to about 10-50 nm. Pike describes that the initial linewidth is controllably etched until the desired gate linewidth is achieved. The desired linewidth is less than 0.25 um (col. 3, line 14-16). It would have been obvious for one skill in the art in light of Pike to determine the desired linewidth through routine experimentation in order to provide optimum linewidth for the gate with a reasonable expectation of success.

7. Claims 7-9, 14, 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pike or McKee/Pike as applied to claims 1 and 15 above, and further in view of admitted prior art.

Referring to claims 7, 8, 14, Pike is silent about etching metal nitride by immersion or spray etching using phosphorous acid at 150-180 degree Celsius. However etching metal nitride by immersion or spray etching using phosphorous acid at 150-180 degree Celsius is well known to one skill in the art at the time of the invention as shown in pages, 6, 13-14 of the specification. Therefore, at the time of the invention, it would have been obvious for one skill in the art to etch metal nitride by immersion or spray etching using phosphorous acid at 150-180 degree Celsius as is known to one skill in the art in order to reduce the metal nitride linewidth and to form a pattern mask for etching the gate with a reasonable expectation of success.

8. Claims 10-13, 18, 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pike as applied to claims 1 and 15 above, and further in view of Decker et al. (US 4,269,654).

Referring to claims 10-13, 18, and 19, Pike is silent about etching the metal nitride using HF, glycol, and water. However, using HF, glycol, and water for etching metal nitride such as silicon nitride is known to one skill in the art as shown here by Decker. The etching T is about 80-120 degree Celsius (claims 1, 3, 5-7). Therefore, at the time of the invention, it would have been obvious for one skill in the art to etch metal nitride in light of Decker because Decker shows the solution for etching the metal nitride and reducing the linewidth of the metal nitride to form a mask for etching the gate with a reasonable expectation of success.

Referring to concentration of the compounds in the etching solution. Decker suggests that the etching rate can be varied by varying the concentration of the HF (col. 3, line 40-42). Therefore, at the time of the invention, it would have been obvious for one skill in the art to determine the concentration of HF and other compounds in the solution through test runs in order to provide optimum concentration to etch the metal nitride with a reasonable expectation of success.

9. Wolf et al. is cited to show prior art, pages 529, 539.

Claim Rejections - 35 USC § 112

10. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

11. Claim 15 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The limitations “photolithographically patterning the metal nitride layer to form a patterned etching” and “anisotropically plasma etching through a thickness of the patterned etching surface to reveal a first exposed portion of the polysilicon containing layer according to a plasma etching process” are vague because it is unclear if the metal nitride is patterned 2 times by the photolithography patterning and then anisotropically plasma etching or 1 time by anisotropically plasma etching using photolithography process. At this time, it is understood as 1 time by anisotropically plasma etching using photolithography process.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n Deo whose telephone number is 703-305-0515.

DVD
12/3/03

